Moles and Particles

$$n = \frac{\#particles}{6.02 \times 10^{23}\ particles/mol}$$

$n = \frac{\#P}{6.02 \times 10^{23}}$

particles
- atoms Mg, Ar
- molecule $C_3H_8(g)$, $H_2O(\ell)$
- formula unit NaCl, $MgCl_2$
- ion PO_4^{3-}
- electrons e^-

3.12 23

EXP

EE

X10□

$X10^x$

particles → mol

Ex: How many moles of sucrose are in a bag containing 3.12×10^{23} molecules?

$$n = \frac{3.12 \times 10^{23}\ molecules}{6.02 \times 10^{23}\ molecules/mol}$$

$n = 0.518\ mol$

5.18×10^{-1}

mol → particles

Ex: A student drinks 2.3 moles of water. How many molecules is this?

$n = \frac{\#P}{6.02 \times 10^{23}}$

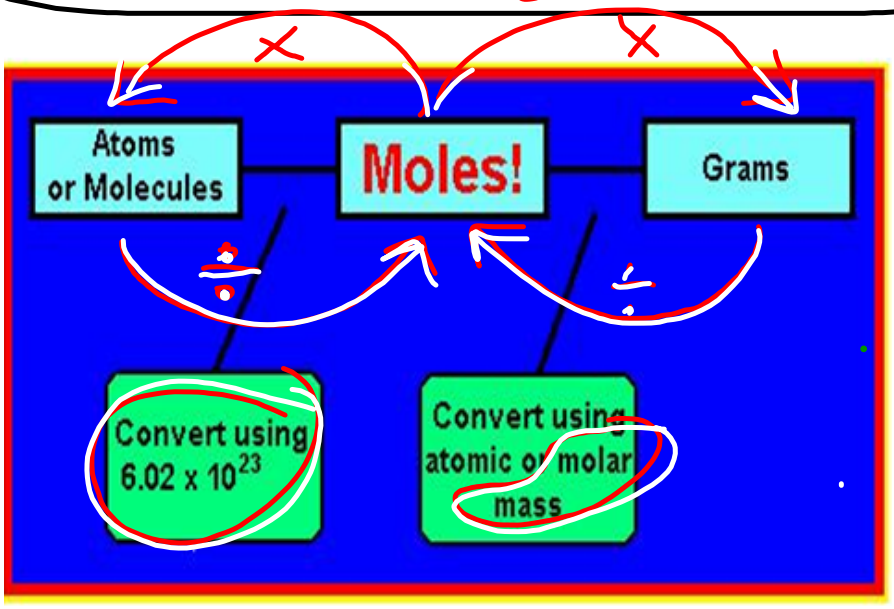
$$2.3\ mol = \frac{\#P}{6.02 \times 10^{23}\ molecules/mol}$$

$1.38 \times 10^{24}\ molecules = \#P$

MOLE CALCULATIONS
(Two steps or one "big step")

$n = \frac{m}{M}$ $\qquad$ $n = \frac{\#particles}{6.02 \times 10^{23}\ particles/mol}$

$\frac{m}{M} = \frac{\#P}{6.02 \times 10^{23}}$



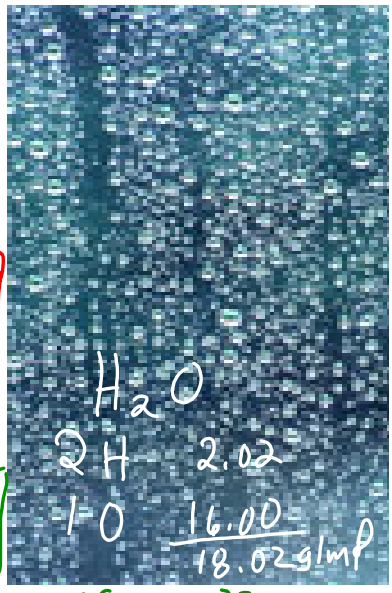
http://misterguch.brinkster.net/molecalculations.html

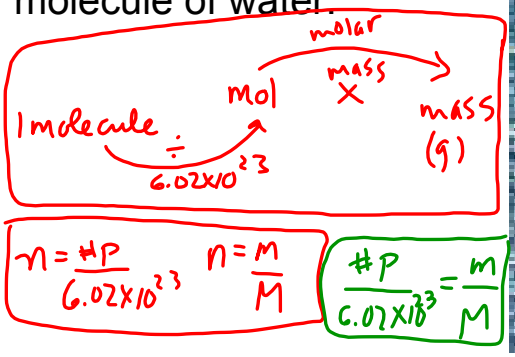
More examples

Ex

Find the mass of one molecule of water.

1.00
1 1.0





$n = \frac{\#P}{6.02\times10^{23}}$ $n = \frac{m}{M}$ $\frac{\#P}{6.02\times10^{23}} = \frac{m}{M}$

ANS: 2.99×10^{-23} g

$$1\text{molecule} \times \frac{1\text{mol}}{6.02\times10^{23}\text{molecules}} \times \frac{18.02\text{g}}{1\text{mol}} = 2.9\times10^{-23}$$

OR

$$n = \frac{P}{6.02\times10^{23}}$$

$$n = \frac{1\text{molecule}}{6.02\times10^{23}\ \frac{\text{molecules}}{\text{mol}}} = 1.66\times10^{-24}\text{ mol}$$

$$n = \frac{m}{M}$$

$$1.66\times10^{-24}\text{ mol} = \frac{m}{18.02\text{g/mol}}$$

$$n = 2.99\times10^{-23}\text{ mol}$$

$$\frac{m}{M} = \frac{\#P}{6.02\times10^{23}}$$

$$\frac{m}{18.02\text{g/mol}} = \frac{1\text{molecule}}{6.02\times10^{23}\ \frac{\text{molecules}}{\text{mol}}}$$

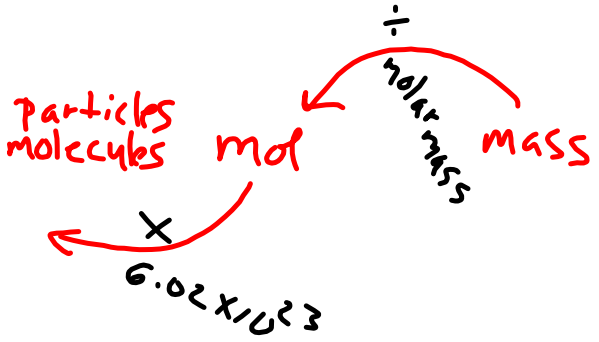
$$m = 2.99\times10^{-23}\text{ g}$$

3×10^{-23} g

Try this:

Ex

Find the number of molecules of sucrose in a 1.000 kg bag purchased at Sobeys.



① $n = \frac{m}{M}$ ② $n = \frac{\rho}{6.02 \times 10^{23}}$

$\frac{m}{M} = \frac{\rho}{6.02 \times 10^{23}}$

12C 144.12
22H 22.22
11O 176.00
342.34 g/mol

1000g

$\rho = 1.76 \times 10^{24}$ molecules

Try this:
Ex 3
Find the number of molecules of sucrose in a 1.000 kg bag purchased at Sobeys.

molar mass ÷ 1000 g mass

molecules × 6.02×10^{23}

$1000\,g \div 342.34\,g/mol \times 6.02 \times 10^{23} = 1.76 \times 10^{24}$ molecules

12 C 12 X 12.01
22 H 22 X 1.01
11 O 11 X 16.00
342.34 g/mol

$\frac{m}{M} = \frac{\rho}{6.02 \times 10^{23}}$

$\frac{1000\,g}{342.34\,g/mol} = \frac{\rho}{6.02 \times 10^{23}}$ molecules/mol

$2.92\,mol = \frac{\rho}{6.02 \times 10^{23}}$ molecules/mol

1.76×10^{24} molecules $= \rho$